Semi-Annual Progress/Technical Report for

Great Lakes Observing System (GLOS) Coordination

Award Number: NA05NOS47311666

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Semi-annual Period: June 1 – November 30, 2007

This report covers the first half of the third year of a three-year grant period. During this period, the Great Lakes Commission (GLC), supporting the GLOS Board of Directors, met all of its obligations under the grant, as detailed within this progress report.

1) Program Summary

The Great Lakes Observing System Regional Association (GLOS-RA) is a non-profit corporation registered in the State of Michigan, established to advance the goals and objectives of the U.S. Integrated Oceans Observing System (IOOS) across the Great Lakes – St. Lawrence River system. IOOS in turn is the U.S. oceans, coastal and Great Lakes component of the Global Earth Observing System of Systems (GEOSS). Further information on the GLOS-RA can be found at: http://www.glos.us/. The GLOS-RA is managed by its Board of Directors with input from staff provided by the GLC.

The GLOS-RA is committed to providing integrated, in-situ, and remotely-sensed information and numeric modeling about the Great Lakes, their interconnecting waterways, the St. Lawrence River, their tributaries and airsheds for use by researchers, managers, industry, educators and others engaged in government, commerce, education, and science on or about the system. The GLOS-RA is also committed to promoting education and outreach to Great Lakes stakeholders about conditions and trends within the system and to informing policy makers and legislators about emerging issues and critical data requirements.

The GLOS-RA will include membership from a wide variety of stakeholders across the region, including federal, state and municipal governmental agencies, Native American communities, academic institutions, commercial ventures, non-governmental organizations and end users of the region's resources. A membership campaign has not yet been initiated since the GLOS-RA governance model is still evolving.

2) Progress and Accomplishments

Work on the project has been on schedule throughout this past year.

- **RA Organizational Structure and Governance**

The GLC has continued to coordinate interagency and user engagement in initiation of the GLOS-RA governance structure. The GLOS Board of Directors was constituted in April 2006 and currently includes the following individuals with their current titles or most recent affiliation:

Officers
Chairman - Mr. Bill Werick, retired Planner, U.S. Army Corps of Engineers, Culpepper, VA
Vice Chairman - Dr. Frank Kudrna, Kudrna & Associates Consulting Engineers, Chicago, IL
Treasurer - Dr. Alfred Beeton, Scientist Emeritus, NOAA-GLERL, Ann Arbor, MI
Secretary - Dr. Jeffrey Boehm, Vice President, John G. Shedd Aquarium, Chicago, IL
Directors
Dr. Gerald Galloway, University of Maryland, College Park, MD
Mr. Mark Grazioli, retired Principal, Wade Trim Consulting Engineers, Grosse, Ile, MI
Mr. Philip Keillor, retired Coastal Engineer, WI Sea Grant, Madison, WI
Dr. Gail Krantzberg, McMaster University, Toronto, ON
Mr. Dale Phenicie, Council of Great Lakes Industries, Peachtree City, GA
Dr. Harvey Shear, University of Toronto, Mississauga, ON
Dr. Richard Stewart, University of Wisconsin-Superior, Superior, WI
Mr. Nelson Thomas, retired Water Quality Specialist, U.S. EPA, Duluth, MN

The GLOS Board has impressive experience in dealing with Great Lakes issues, including economic development, industrial pollution control, municipal water system operations, ecological protection, binational coordination, public education and tourism, project plan formulation and implementation, information management and stakeholder conflict resolution. Further information on each member of the inaugural GLOS Board can be found at: http://www.glos.us/about/board.php. The GLOS-RA is well positioned to address the diversity of needs of the Great Lakes – St. Lawrence River system.

During this report period, the GLOS Board met on one occasion, June 6, 2007 in Chicago, IL to continue coordination of GLOS-RA activities. Monthly conference calls were conducted in each month of this semi-annual reporting period (except June), with each Director participating the majority of occurrences. The GLOS-RA Bylaws, adopted in June 2006, were followed with significant exception over this period. They can be found at: http://www.glos.us/bylaws/2006Bylaws.pdf. The major exception revolves around the lack of a formal membership structure being in place to support creation of a Program Review Panel (PRP), which is designed to provide data providers and data users direct input into resource allocation decisions. Membership also is critical to sustain uninterrupted composition of the GLOS Board of Directors. IOOS leadership has not yet satisfactorily resolved how federal agencies can engage with an RA, causing membership in the GLOS-RA to be stymied. The

Great Lakes region has a major binational federal engagement in the research, design, operation, maintenance of observing systems. Without overt U.S. and Canadian federal agency engagement, the GLOS-RA can not fully meet its goals to plan, design, implement or operate an integrated observing system or create sustainable products that meet documented needs. The Board is expected to begin soliciting members from non-federal entities with defined roles, responsibilities and benefits that membership will entail during the second-half of this grant period.

Mr. Roger L. Gauthier of the GLC staff was appointed as the Interim Executive Director for the GLOS-RA in June 2006. He is responsible for managing conduct of a variety of data, communications, budgetary, administrative, and staff oversight assignments, as outlined in the GLOS-RA Bylaws.

The GLC will continue to provide staffing for the GLOS Secretariat through May 30, 2008, as a function of the current planning grant. The GLC is the recipient of funding for the GLOS-RA through that date. After July 1, 2007 it is expected that the GLOS-RA will be the direct recipient of funding to maintain RA functions. A Memorandum of Agreement between the GLOS Board and GLC was approved in February 2007 to formalize commitment of manpower resources to meet GLOS-RA needs. GLOS Secretariat support over this semi-annual reporting period included significant time and travel for GLC staffers including Jon Dettling, Matt Doss, Roger Gauthier, Peter Giencke, Christine Manninen and Guan Wang.

Over this semi-annual reporting period, the GLOS Board has been primarily focused on providing oversight on proposal development affecting out-year funding. These included: a) revision of the 2007 Regional Ocean Observing System (RCOOS) proposal to address high priority first year system development for $500,000 over the period October 1, 2007 through September 30, 2008; development of the follow-on “planning grant” for a potential three-year period starting on June 1, 2008 through May 30, 2011; and development of a comprehensive three year “systems” proposal for 2008-2011 under the NOAA 2008 Regional Integrated Ocean Observing System (RIOOS) federal funding opportunity solicitation.

During this semi-annual reporting period, the Board continued to engage its subsystem teams, composed of recognized subject matter experts involved in Great Lakes issues. The subsystem teams have provided valuable input to the GLOS Board and Secretariat for preparation of the GLOS Annual Work Plan and development of focused proposals for out-year funding. The GLOS Board has developed evaluation criteria to help determine priorities for resource allocations and for assessing prospective value-added products that meet IOOS societal goals within the Great Lakes – St. Lawrence River region.

The GLOS Board also adopted Financial Policies and implemented Conflict of Interest statements during this period. Directors and Officers Liability Insurance has been purchased to partially indemnify officers of the Non-Profit Corporation. An application for 501(c) 3 tax-exempt status through the Internal Revenue Service has been drafted and will be submitted to the Internal Revenue Service for consideration soon.

- **Planning and Implementation**

The inaugural GLOS Business Plan was completed in November 2004. The plan included: goals and objectives of the organization; needs assessment; outline of subsystems and components; procedures for product development and periodic review; approaches for data management and communication, research and development, and education and outreach; preferred governance model for the organization; funding opportunities; and, marketing approaches. The GLOS Business Plan is available at: http://www.glos.us/businessplan/GLOS_BP_2004.pdf. The business plan will be revisited in 2008 to reflect the interests of the GLOS Board particularly with respect to lessons learned over the last four years on needed regional observing improvements and high value integrated products.

The 2nd GLOS Annual Work Plan covering the period July 1, 2007 through June 30, 2008 has been drafted but not yet finalized or approved by the GLOS Board. This annual cycle corresponds with most state financial years within the region and generally corresponds with the NOAA grant cycle that funds the GLOS-RA. The annual work plan will identify key activities, implementation responsibilities, timelines and budgets for the GLOS-RA over the current fiscal year. Its completion an adoption has been intentionally delayed to insure that on-going proposal development and funding can be incorporated into the work plan. The 2nd GLOS Annual Work Plan is expected to be finalized and approved by the GLOS Board in February 2008.

- **Stakeholder Engagement**

Workshops, Meetings and Conferences Attended

GLOS Directors and Secretariat staff participated, and in some cases hosted, six major events during this semi-annual reporting period that affected GLOS planning, systems integration and regional DMAC implementation.

- IJC Biennial Conference – On June 7-8, 2007, Roger Gauthier and Dale Phenicie participated in the International Joint Commission (IJC) Biennial Conference in Chicago, IL. Approximately 250 attendees participated in this two-day event which focused on current Great Lakes issues, status reports on indicators developed under the State of the Lakes Ecosystem Conference (SOLEC) and related observing/monitoring regional needs.

- Remote Sensing of Coastal Wetlands Workshop – On September 13-14, 2007, the GLOS-RA co-sponsored a workshop with the Eastern Great Lakes Region, American Society for Photogrammetry and Remote Sensing Summer and the Association of Wetlands Scientists on various methods for periodically assessing the extent, composition and vigor of Great Lakes coastal wetland resources. Over 40 people attended this workshop which included a field trip of coastal wetlands in southeast Michigan which are being overrun by aggressive invasive macrophytes.

- Cooperative Science Initiative Workshop – On September 18-19, 2007, the GLOS-RA was represented by Roger Gauthier and GLOS Director Dale Phenicie, in a two-day

workshop in Windsor, ON to coordinate observing initiatives, binational monitoring programs and collaborative research on current and emerging threats to the ecological balance of the Great Lakes – St. Lawrence River system. Over 40 U.S. and Canadian federal, state, provincial and academic institutions participated in this workshop convened by the Great Lakes Binational Executive Committee (BEC).

- Great Lakes Regional Collaboration Meeting – On October 2, 2007, about 120 people participated in a half-day meeting in Chicago, IL, including Roger Gauthier and GLOS Director Dale Phenicie to discuss status of key recommendations from the 2005 GLRC Strategy Report, including actions that the GLOS-RA should lead or coordinate.

- NFRA Regional Association Workshop – On October 24-25, 2007, the GLOS-RA was represented by Roger Gauthier, Peter Giencke, Christine Manninen and GLOS Director Frank Kudrna in this workshop in St. Pete Beach, FL which focused on advancing national and regional plans for RCOOS and DMAC programs.

- Great Lakes Regional Data Exchange (RDX) Conference – On October 29, 2007, the GLOS-RA co-sponsored this conference in Ottawa, Canada with significant focus on binational data management and cooperative observing programs. The GLOS-RA was represented by Jon Dettling, Roger Gauthier, Peter Giencke, Christine Manninen and Guan Wang. Several members of the GLOS Information Integration Subsystem Team participated as well. Mary Altalo, Director of Ocean.US, presented the keynote address.

- "Making a Great Lakes Superior" Conference – On October 29 - November 1, 2007, about 300 people attended this conference in Duluth, MN, with some key discussions on GIS, information management, observing/monitoring programs, climate change impacts, coastal processes and Great Lakes hydraulics/hydrology. The GLOS-RA was represented by GLOS Chairman Bill Werick, along with members from several subsystem teams.

In addition to these very important meetings, GLOS Secretariat staff and/or Board members participated in the following events with a focus on coordinating GLOS implementation and subsystem prioritization efforts:

- Lake St. Clair Water Quality Monitoring Workshop – June 4, 2007 in St. Clair Shores, MI attended by Roger Gauthier with discussions on GLOS modeling plans;
- ESRI User Conference – June 18-22, 2007 in San Diego, CA attended by Peter Giencke to learn more about commercially available solutions to aggregate spatial data and disseminate information, both cornerstones of GLOS-DMAC activities;
- U.S. Group on Earth Observations, User Interface Committee Meeting – July 31 – August 1, 2007 in Washington D.C., attended by Roger Gauthier to showcase GLOS' binational activities;
- Macomb/St. Clair Inter-County Water Quality Advisory Board Meeting – August 15, 2007 in Mt. Clemens, MI, attended by Roger Gauthier to coordinate GLOS modeling plans and information management activities;

- International Lake Superior Board of Control Public Meeting – September 4-5, 2007 in Sault Ste. Marie, MI, attended by Roger Gauthier to assess climate monitoring needs;
- 2007 National States Geographic Information Council (NSGIC) Conference – September 23-27, 3007, with Peter Giencke making a plenary presentation to over 300 attendees from all 50 U.S. states on regional information management supported by the GLOS-RA;
- Great Lakes Commission Annual Meeting – October 1-2, 2007 in Chicago, IL, attended by Roger Gauthier and Christine Manninen, with a focus on climate change implications;
- Macomb Water Quality Board Meeting – October 9, 2007 in Mt. Clemens, MI, attended by Roger Gauthier to present on GLOS modeling and climate change impact assessments;
- Macomb/St. Clair Inter-County Water Quality Advisory Board Meeting – August 15, 2007 in Mt. Clemens, MI attended by Matt Doss to coordinate GLOS modeling plans and information management activities;
- GLOS Open Water Subsystem Team Meeting – October 12, 2007 in Ann Arbor, MI, convened by Jon Dettling and Roger Gauthier, with nine regional collaborators;
- Great Lakes Protection Fund Regional Data Strategy Meeting – October 16, 2007 in Ann Arbor, MI involved several GLC staffers engaged in the development of the GLOS-DMAC which was showcased;
- Inland Seas Educational Association Monthly Meeting – October 16, 2007 in Suttons Bay, MI, with GLOS-RA activities being presented by Roger Gauthier;
- NOAA Coastal Services Center Visit – October 18-19, 2007 in Charleston, SC by Roger Gauthier and Peter Giencke to discuss GLOS-RA program activities and DMAC implementation issues;
- SEACOOS-IOOS Workshop – October 22-23, 2007 in St. Pete Beach, FL, attended by Roger Gauthier and Peter Giencke to learn how SEACOOS has networked observing and data management personnel within their region and how technologies will be implemented to implement its RCOOS and DMAC plans; and
- Michigan Department of Environmental Quality Great Lakes Hydrology Briefing – November 5, 2007 with Roger Gauthier presenting information on GLOS hydrodynamic modeling plans for the St. Clair River.

New Partnerships

During this semi-annual reporting period, GLOS Secretariat staff worked with several members of the U.S. Environmental Protection Agency, Region V in Chicago, IL and Office of Research and Development from Research Triangle Park, NC to generate proposals for funding from the national Advanced Monitoring Initiative – Global Earth Observing System of Systems (AMI-GEOSS) program. Several of these proposals have direct relevance to identifying the magnitude, timing and extent of chemical, nutrient and sediment loadings to the Great Lakes. Two AMI-GEOSS proposals of merit were funded for work in the federal FY 08 period; the first, addresses development of operational procedures for using daily MODIS imagery to land use changes on an annual basis, and the second is focused on determining overland contaminant loading affecting beach closures, using high-resolution nearshore hydrodynamic modeling which is being promoted by the GLOS-RA.

Secretariat staff also worked closely with members of the Lake Michigan Monitoring Coordination Council (LMMCC) on a National Monitoring Network (NMN) pilot project to identify critical observing system needs for Lake Michigan and its drainage basin. The NMN pilot project is one of three pilots identified by the USGS across the nation, with the others being Delaware Bay and San Francisco Bay. The LMMCC involves several U.S. federal agencies (USGS, USEPA, USACE, USF&WS, USDA-NRCS and NOAA), state agencies from Michigan, Wisconsin, Indiana and Illinois, the Great Lakes Commission and several adjacent universities. The NMN is called for by the National Water Quality Monitoring Council under the U.S. Ocean Action Plan. The Lake Michigan pilot is expected to be used to assess observing needs for all five Great Lakes. Further information on the LMMCC and the Lake Michigan pilot project can be found at: http://wi.water.usgs.gov/lmmcc/index.html.

The GLOS-RA has supported coordination efforts that have been undertaken by collaborating organizations. For example, GLOS staff has provided assistance to the Great Lakes Association of Scientific Ships (GLASS) in planning and conducting its annual meeting in January of each year. There are more than 100 members of the maritime community that convene on an annual basis to coordinate field data collection operations, share information resources and identify community priorities. Most of the Information Integration subsystem members are actively engaged in the planning and conduct of Great Lakes RDX conferences and workshops. Most members of the Education/Outreach subsystem team are actively supporting a new Great Lakes Regional Research Information Network (GLRRIN) endeavor to better coordinate research activities across the region.

- **Regional Observing Systems Coordination**

A major focus of the GLOS-RA during this last year has been continuing discussions with regional entities, including federal agencies, state departments, provincial ministries and academic institutions, to refine subsystem design and implementation planning for the period 2008-11. These coordination activities have engaged subject matter experts in developing an integrated and cohesive vision for each of the following GLOS subsystems:

- Offshore / Deep Water
- Scientific Ships
- Nearshore and Coastal
- Interconnecting Waterways
- Remote Sensing
- Atmospheric Monitoring
- Process Modeling and Ecological Forecasting
- Information Integration
- Education and Outreach

More than 90 regional subject matter experts from across the Great Lakes region have participated in proposal development which involves the nine GLOS subsystems. The subsystem teams conduct periodic conference calls to determine priorities for observing system

improvements and integrated products. Information on the objectives of each subsystem team and its members is at: http://www.glos.us/subsystemteams/GLOS_Subsystem_Roster_2007.pdf.

- **Coordination of Federal Backbone Observations**

The GLOS-RA has continued to seek funding to implement new Great Lakes CoastWatch products including daily lakewide surface products for chlorophyll, organic solids and surface sediment loads have been explored. These new products could be produced from existing space-borne sensor arrays including MODIS, SeaWIFS and AVHRR and delivered to end users on a daily basis. Each of these three operational products are needed to monitor organic, contaminant and sediment loads to the Great Lakes, which in turn can be used to assess performances on meeting water quality management targets and to monitor harmful algal bloom development. This work has been included in a recent RCOOS funding request to NOAA.

During this semi-annual reporting period, the GLOS-RA has continued to promote activities of the NOAA National Data Buoy Center (NDBC) across the region. GLOS staff has continued to push fixing observing system shortfalls identified in July 2005 letters sent by the GLC to the NDBC outlining the needs for additional sensor enhancements to the existing buoy network and densification of observation stations across the lakes. The observation programs of the NDBC are a critical backbone component of the GLOS Offshore and Nearshore subsystems and are needed to improve nearshore marine forecasts. Maintenance of existing meteorologic observations at the Lake St. Clair C-MAN site is particularly important, including the additions of new observations of surface currents and biological activity. The Lake St. Clair installation is a key observation node needed to model contaminant transport mechanisms within the lakes Huron to Erie Corridor (HEC). The NWS has implemented ten new shore stations to collect observations needed for nearshore marine forecasts.

The GLOS-RA has continued to coordinate plans for the development and implementation of hydrodynamic modeling for the HEC, along with installation of dedicated Acoustic Doppler Current Profilers (ADCPs) in the St. Clair River, Lake St. Clair and the Detroit River. This activity is driven by the need to protect drinking water supplies for 4 million residents in southeast Michigan and southwest Ontario. These activities are components of the GLOS Interconnecting Waterway subsystem and engage elements in NOAA, USEPA, USACE, USGS, Environment Canada, and state and provincial agencies. Limited funding received to support RCOOS implementation starting in October 2007 for this important initiative.

- **Regional Data Management and Communication (DMAC)**

Regional coordination has continued in the design, development and implementation of the GLOS Data Management and Communication (DMAC) subsystem over this year. The eight Great Lakes states maintain geospatial data resources which need to be accessed through a GLOS web mapping portal. Data needs of the Coastal Zone Management (CZM) programs within the region have been inventoried, which are the basis of database modeling for the GLOS enterprise.

During this semi-annual reporting period, GLOS-DMAC efforts have continued to focus on the system design requirements for incorporating the following principal information resources:

- a comprehensive binational (U.S. and Canada) monitoring inventory;
- NOAA's CoastWatch Great Lakes products;
- framework geospatial datasets and detailed geospatial mapping of coastal, open lake and riverine conditions collected under the International Joint Commission (IJC's) Lake Ontario – St. Lawrence River Study;
- water level and meteorological observations collected by NOAA-CO-OPS; and
- air emissions datasets from the eight Great Lakes states and the province of Ontario; and,

The GLOS-DMAC has been supporting re-design efforts of the Great Lakes Information Network (GLIN) to act as a comprehensive clearinghouse node for geospatial data collected and maintained over the region. Geospatial data, including those collected from open lake moorings and remotely sensed observations are being factored into design of the GLOS-DMAC. A Service Oriented Architecture is the preferred approach for GLOS-DMAC design. GLOS technical staff and collaborators have attended relevant national DMAC meetings (OOS-Tech, DMAC Steering Committee, etc.) to insure that regional development is being conducted in concordance with rapidly evolving DMAC protocols and certification requirements.

The GLOS-DMAC architecture has identified the following critical factors:

- additional server capacity to support distributed geospatial data management;
- enhanced bandwidth to support data transport between federal, state and academic users;
- additional storage capacity to support regional data archiving and derived products;
- automated methods for ingesting data;
- multi-disciplinary product development teams; and,
- redesign of GLIN to support product distribution.

Data ingestion will involve bringing in real-time in-situ observations, computer modeling output and raster datasets. In-situ observational data taken from sensor platforms (e.g., water level gauges, buoys) would be ingested in real-time using open source protocols (e.g., XML, Web Services, netCDF). Modeled outputs would be added including estimated, interpolated and forecasted values, such as weather and lake circulation predictions.

Web products to be developed include dynamic maps of in-situ observations highlighting the spatial distribution of phenomena across the Great Lakes or within their interconnecting waterways. These products should include graphs, statistics and animations depicting both real-time and historical phenomena to showcase significant trends, events, and other features.

Product distribution is based upon evolving Web Services (e.g., Web Feature Service (WFS), Sensor Web Enablement (SWE) and SensorML formats) to ensure maximum interoperability and access to data. By utilizing common and standardized formats for data and using Web Services as a distribution channel, the GLOS-DMAC is designed to support a diverse group of

end users, enabling the development of additional websites, further analysis, data conversion and other value-added operations.

The GLOS-DMAC team has developed an initial proof-of-concept for the Great Lakes "HarborView" project. This 15 minute animated movie showcases how output from the NOAA Great Lakes Forecasting System and point observations around the lake can be delivered to mariners as they transit from one location to the other across the lakes. Funding to initiate the HarborView project for 25 high traffic locations across the Great Lakes has been received from NOAA under an RCOOS grant.

Web Page Development

During this last year, the GLOS-RA further improved its web page including prototype development of a regional map interface to the GLOS Great Lakes Observation Registry, providing the most recent observations for users using mobile communication devices.

The current version of the GLOS web page also provides access to:

- background information on the GLOS initiative, including contact information for the Board of Directors, the Subsystem Teams and the Regional Interest Group, the Business Plan; the current Annual Work Plan, the GLOS Bylaws; and membership information;
- agenda and proceedings of all GLOS-RA meetings and conference calls:
- an events calendar;
- a user needs survey area;
- current lake conditions, including water levels, surface temperatures, meteorologic observations, weekly weather and water level forecasts, and links to an experimental buoy in Grand Traverse Bay;
- links to other collaborators including IOOS, other RAs, supporting agencies, Great Lakes regional partners and relevant publications;
- Great Lakes news stories including those on observations and monitoring programs across the region; and,
- past GLOS Update articles, including those written during this past year.

- **Education and Outreach**

During this semi-annual reporting period, the GLOS-RA continued to work with the Great Lakes Sea Grant Network (GLSGN) to implement an education and outreach campaign to promote the objectives of the GLOS-RA. This broad public awareness campaign involves an oversight committee with representation from all seven state programs in the GLSGN. The Committee meets via monthly conference calls.
The current GLOS Annual Work Plan identifies strategic activities for education and outreach activities, including:

- further assessments of user needs, gaps and deficiencies in existing services;

- design and promotion of a GLOS awareness campaign;
- development of promotional materials (e.g., fact sheets, news releases, newsletters); and,
- convening of workshops to highlight modeling and remote sensing initiatives.

Education efforts will build information-sharing relationships between data providers and educators and their students. Outreach efforts seek to engage and inform potential user groups and to seek their input in the design, implementation and product delivery for GLOS. Education planning is being coordinated with the Great Lakes Center for Ocean Sciences Education Excellence (COSEE). The Great Lakes COSEE was funded by the National Science Foundation in November 2005 to create dynamic linkages between Great Lakes and ocean research and education with the goal of enhancing scientific literacy and environmental stewardship.

Other outreach activities include implementation and update of a project Wiki. The GLOS Wiki has been created to provide additional capacity for outside contributors to collaborate on the design and conduct of GLOS. The Wiki provides for a discussion forum between members of the GLOS Board, its committees, subsystem technical experts and others to exchange and archive information relevant to the endeavor.

3) Scope of Work

- **RA Establishment, Membership and Staffing**

The GLOS-RA has been established as a nonprofit corporation in the state of Michigan, with adopted bylaws, a formal governance structure and a mechanism for engaging stakeholder input for defining resource allocation priorities. Recognition of tax-exempt status by the Internal Revenue Service is still pending but should be concluded within the next few months.

A formal membership campaign is currently being designed and is expected to be initiated in early 2008. This campaign includes information for prospective members including roles, responsibilities and benefits. The GLOS Board of Directors has determined that no dues will be charged for the next two years and that federal agencies would be invited to participate as partners not members. Federal agency representatives would be allowed to vote for members of the Board of Directors, but would be prohibited from being on the Board themselves due to conflicts of loyalty/interest.

Staffing for the GLOS-RA has been provided by the GLC, with approximately 2.2 full-time equivalent staff level being provided over this semi-annual reporting period. The GLOS Board and the GLC have formalized a working relationship under a Memorandum of Agreement which still needs to be amended to reflect operational changes necessary for the period June 1, 2007 through May 30, 2008.

- **Enhanced User Needs Assessment**

A cursory user needs assessment took place as part of GLOS Business Plan submitted to NOAA in 2004. Over this semi-annual reporting period, the GLOS subsystem teams have further defined these requirements, principally dealing with the following major regional issue areas:

- climate change detection and identification of impacts, particularly in nearshore waters;
- protection of public health with emphasis on drinking water supplies and use of public bathing beaches;
- food web dynamics related to chemical and nutrient movement in nearshore waters; and,
- commercial navigation and recreational boating needs for improved channel conveyance forecasts for the St. Marys, St. Clair/Detroit and St. Lawrence rivers.

In its strategy report released in December 2005, the GLRC recommended that specific activities be conducted by federal, state, county and municipal governments over the next five years to restore and protect Great Lakes ecological resources. These recommendations included a wide array of large-scale programs including restoration of coastal wetlands, protection of drinking water supplies, insuring safe public bathing beaches and reduction of toxics and non-point pollution loadings, all of which require an improved observing frame across the system. These drivers for improving the observing system functionalities are primarily focused on being able to adequately model and monitor spatial and temporal changes in loadings of contaminants, nutrients and sediments to the Great Lakes – St. Lawrence River system. The strategic goals expressed in the GLRC require greater spatial density of meteorologic, chemical, biologic and physical observations and integrated information resources including modeling and visualization. One focal area of the GLRC Strategy Report was the Indicators and Information Strategy Team's appendix that outlined strategic improvements for observation and monitoring programs, implementation of indicator systems developed to measure progress, networking of information resources, research prioritization and improvements in communication systems. This annex outlines specific areas of focus for the GLOS-DMAC subsystem to address in years to come.

- **Subsystem Cost-Benefits Assessments**

Specific cost-benefit assessments for proposed GLOS regional observing subsystem components have not been conducted during this semi-annual reporting period. Procedures and metrics still need to be developed to support long-term prioritization of resource allocations and funding for subsystem improvements that can be implemented with programmed funding resources.

4) Problems Encountered

Participation from all U.S. federal agencies engaged in the Great Lakes region has been inconsistent, principally due to the lack of real funding for RCOOS implementation. Engagement of representatives from NOAA, USF&WS, USGS, and USCG has been consistent from the beginning of the GLOS-RA. During this reporting period, further U.S. federal engagement has occurred under the auspices of the Lake Michigan NMN pilot project.

Soliciting buy-in from state organizations, academic institutions and non-governmental

organizations has been a continuing challenge, particularly since significant RCOOS funding has not yet been realized. Work conducted by the GLC Secretariat staff in support of the GLRC, particularly dealing with the Indicators and Information Strategy Team, has been instrumental in advancing the potential role of GLOS across the region. Engagement of the GLOS Board and Secretariat with the Binational Executive Committee to support binational work under the Great Lakes Water Quality Agreement still needs to be emphasized.

Development of formal partnership agreements between the GLOS Board and major federal agencies with responsibilities in the Great Lake – St. Lawrence River system is still a daunting challenge. NOAA has as many as 19 weather forecast offices under two regions. NOAA also has research facilities (e.g., GLERL) and other elements within the region. The USACE has three districts operating in the same domain. The USEPA has two regions covering the lakes, one national program office and one major research facility within the region. The USGS has one regional coordinator but eight district offices that would need to be signatories to any GLOS membership agreement. The NFRA, NOAA-IOOS Program Office and Ocean.US need to provide more assistance in insuring that partnering occurs at the highest practical level.

Due to the binational nature of the Great Lakes – St. Lawrence River system, monitoring of the meteorology, hydrology, hydraulics, biology, chemistry and physical attributes of the system need Canadian involvement. Canadian participation in the design and implementation of the GLOS-RCOOS has largely been non-existent so far. Formal relationships with Ontario governmental agencies are still lacking. Outreach to Quebec federal and state representatives has, nevertheless, been noteworthy, although implementation of the St. Lawrence Global Observatory (SLGO) initiative has been stymied over the last six month due to lack of funding commitments. It is anticipated that the GLOS-RA and SLGO would work closely in creating integrated web service delivery of data across the upper and lower St. Lawrence River valley. Binational coordination between U.S. and Canada needs to be promoted at a higher degree by the NOAA-IOOS Program Office, Ocean.US and by participating U.S. federal agencies.

5) Leadership Personnel

There have been no changes in principal GLC staff supporting this project during this past year. A total of 2.2 full-time equivalent staffing has been provided by the GLC to support the GLOS-RA development during this semi-annual reporting period.

6) Budget Analysis

Work through November 30, 2007, has required the expenditure of slightly more than 50 percent of the total funds provided by NOAA for the third year of the multi-year grant ($204,000 out of $400,000). Travel, communication and contract expenses have exceeded original budget estimates, but have been offset through cutbacks in expenses for personnel, fringe benefits, indirect and equipment acquisitions.